

# **SPEEDBOX MINI-INS** - Unbeatable Measurement Accuracy

**Roll, Pitch, Yaw, heading, gradient, velocity, accelerations, and distance all at 200Hz**



- <10cm error for 100 to 0 km/h braking tests.
- 2cm absolute positional accuracy with optional GPS2 RTK unit.
- Compact and quick to install.
- 200Hz output on serial and CAN.
- 0.08 degrees yaw, 0.04 degrees roll and pitch accuracy.
- Tactical grade IMU ensures no outages even with challenging GPS conditions.

The SPEEDBOX-INS range is our purpose designed automotive testing solution offering enhanced accuracy and flexibility over the standard SPEEDBOX product. The system comprises of a SPEEDBOX unit coupled with a sensor and antenna assembly mounted to the roof of the vehicle.

Two models are available to suit the application:

- **SPEEDBOX-INS Tactical Dual Antenna** - Stationary initialisation, suitable for low dynamics and applications with frequent stationary periods.
- **SPEEDBOX-INS Tactical Single Antenna** - Compact and aerodynamic, achieves the same accuracy, but requires a short initialisation period.



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The **Single Antenna SPEEDBOX INS** system is favoured for most applications including industrial testing. The system's compact size makes it ideal for aerodynamic and space critical applications, and is ideal for use on professional racing vehicles and motorcycles. The high dynamic attitude data being used to improve driver performance and to tune and develop chassis and suspension. The single antenna system requires a short initialisation phase before it outputs converged data.

**Dual Antenna SPEEDBOX INS** systems feature the larger roof antenna assembly. The dual antenna INS system is fitted and ready in minutes, outputting data as soon as it gets a GPS lock. The dual antenna layout is favoured for slower moving vehicles that see lower driving dynamics, the ability to initialise whilst stationary being an important function of the system. Typical uses include large off highway and agricultural vehicles.

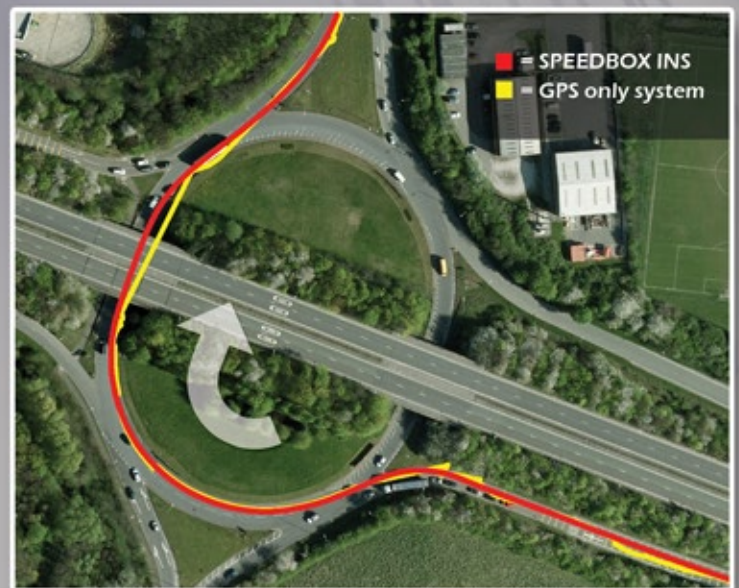


*SPEEDBOX-INS Dual Antenna assembly mounted on a vehicle at approximate scale*

The INS sensor is connected to the main SPEEDBOX unit, where the raw inertial and GPS outputs are combined (using complex algorithms and Kalman filtering) in real time to accurately measure vehicle roll, pitch, yaw, acceleration, velocity, distance, gradient and heading as well as position. All measurements have a very low latency of just a few milliseconds, and are output at a rate of 200Hz with no interpolation. Because the unit uses high precision accelerometer and gyro sensors, it can fill in any short GPS outages without any significant loss in accuracy, making it ideal for on highway testing as well as test tracks.



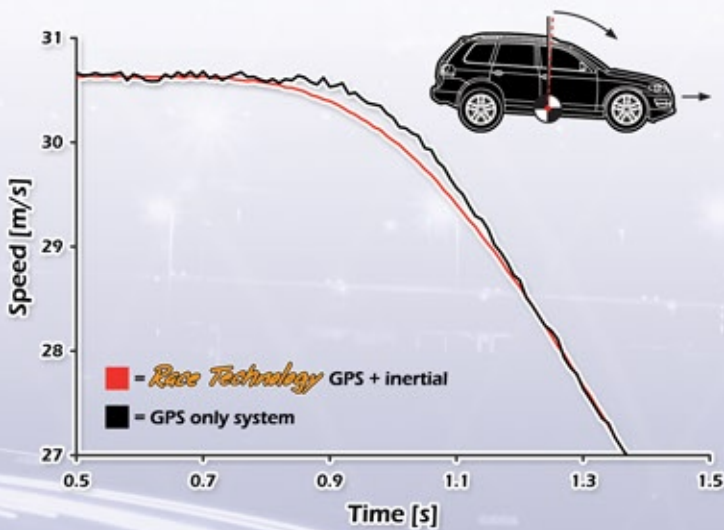
The example below shows the SPEEDBOX INS system compared against a GPS only system in difficult GPS conditions. With trees lining the road and the vehicle driving under the road bridge. The SPEEDBOX INS system retains excellent data throughout





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## No Speed Overshoot Under Braking:



## No Speed Overshoot

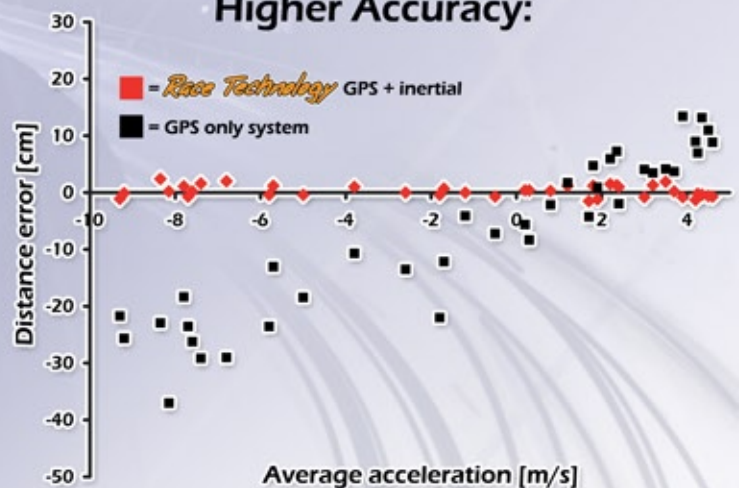
During brake testing a GPS-only system suffers from speed overshoot, as the brakes are applied the vehicle pitches and the roof mounted GPS antenna accelerates forwards. The time difference as the car decelerates past 100km/h (27.78m/s) and triggers the start of the test is only a few milliseconds (15-20ms), but at 100km/h the distance travelled in a few milliseconds is significant (~0.5m).

The SPEEDBOX-INS allows the measurement point to be accurately offset to the centre of gravity giving a true speed measurement with no overshoot. The inertial sensors accurately measure pitch and rotation rates to the reference point achieving unbeatable accuracy of just a few cm for all automotive braking tests.

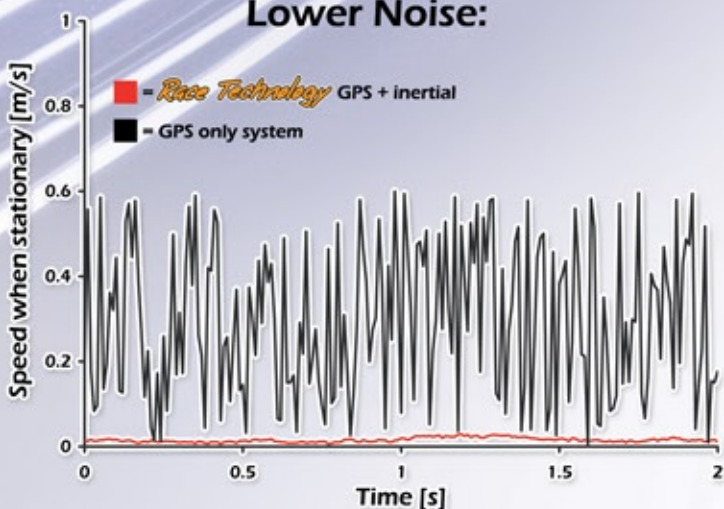
## Consistent High Accuracy Results

The SPEEDBOX-INS gives consistent high accuracy measurements under all testing scenarios. Measurements are precise and unaffected by accelerations and decelerations; vehicle pitch, roll and yaw.

## Higher Accuracy:







## Lower Noise:



## Low Speed Noise

Low speed tests provide the toughest challenge to the accuracy of non-contact speed measurement systems. Errors often show up as high noise when stationary. Many manufacturers remove this noise by implementing a crude zero-clamp on the output, so it is impossible to see any data below 0.5m/s, for example. This is a particular problem with all GPS only speed sensing systems as speed errors at rest are normally significantly higher than speed errors when moving.

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	 SPEEDBOX-INS <b>Dual Antenna</b>	 SPEEDBOX-INS <b>Single Antenna</b>
Accelerations	200Hz, 0.01m/s <sup>2</sup>	200Hz, 0.01m/s <sup>2</sup>
Speed	200Hz, 0.015m/s	200Hz, 0.015m/s
Distance	200Hz, 3cm in 40m	200Hz, 3cm in 40m
Position	200Hz, 2m (2cm with GPS2 RTK option)	200Hz, 2m (2cm with GPS2 RTK option)
Roll / Pitch / Yaw rate	200Hz, 0.01 deg/s	200Hz, 0.01 deg/s
Yaw accuracy	200Hz, 0.08 deg	200Hz, 0.08 deg
Roll / Pitch accuracy	200Hz, 0.04 deg	200Hz, 0.04 deg
Initialisation	While stationary or moving	Only while moving
Braking test accuracy	<10cm (100 to 0 km/h)	<10cm (100 to 0 km/h)
	 SPEEDBOX-INS <b>Dual Antenna</b>	 SPEEDBOX-INS <b>Single Antenna</b>

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